

# PATENT COOPERATION TREATY

## PCT


### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 02 MAR 2005

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Applicant's or agent's file reference 101.0098PCT	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/GB2004/000197	International filing date (day/month/year) 20.01.2004	Priority date (day/month/year) 03.02.2003	
International Patent Classification (IPC) or national classification and IPC G01D5/353, G01K11/32, G01L1/24			
Applicant SENSOR HIGHWAY LIMITED			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau) a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  02.08.2004		Date of completion of this report  03.03.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  Arca, G  Telephone No. +31 70 340-2773	



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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-43 as originally filed

**Claims, Numbers**

1-77 as originally filed

**Drawings, Sheets**

1/5-5/5 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

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1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 3-34, 36-38, 41-72, 74-76

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 3-34, 36-38, 41-72, 74-76

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☒ See separate sheet for further details

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**Box No. IV Lack of unity of invention**

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1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☒ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-34, 36-72, 74-76 .

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	2, 40
	No: Claims	1, 39
Inventive step (IS)	Yes: Claims	2, 40
	No: Claims	1, 39
Industrial applicability (IA)	Yes: Claims	1, 2, 39, 40
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

Reference is made to the following document:

D1: US-A-5 757 487 (KERSEY ALAN D) 26 May 1998 (1998-05-26)

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

In view of the large number and also the wording of the claims presently on file, which render it difficult, if not impossible, to determine the matter for which protection is sought, the present application fails to comply with the clarity and conciseness requirements of Article 6 PCT (see also Rule 6.1(a) PCT) to such an extent that a meaningful search is impossible. Consequently, the search has been carried out for those parts of the application which do appear to be clear (and concise), namely an optical fiber with an array of sensors, which are interrogated by launching a plurality of preselected wavelengths along the fiber, and where a method of determining the absolute value of the Optical Path Length (OPL) of the sensors is employed, based on computing the OPL with an iterative algorithm. The iterative algorithm is based on an estimation of the derivative of the phase of an optical interference signal as a function of wavelength. The apparatus and the method of interrogation are disclosed on pages 5, 12, 22-23 of the description and in claims 1, 2, 39 and 40.

**Re Item IV**

**Lack of unity of invention**

The best prior art has been identified as US5757487 (Alan D. Kersey). In US5757487, there is a plurality of laser light sources (14, 15, 16...N) launching light at different wavelengths  $\Lambda_1$ ,  $\Lambda_2$ ,  $\Lambda_3$ ... $\Lambda_N$  in an optical fiber (23). The optical fiber (23) comprises a series of reflectors (13) arrayed (11) along the fiber (23). A return optical signal for each of the wavelengths  $\Lambda_1$ ,  $\Lambda_2$ ,  $\Lambda_3$ ... $\Lambda_N$  is collected and analyzed to determine a parameter of interest at a given location along the fiber (col. 2, lines 50-55). The value of this parameter is derived from the measurement of an optical path length (OPL) between the reflectors (col. 4, lines 30-40; fig. 1). Hence, claim 1 is known from the best prior art.

The first invention (claims 1-34, 36-72, 74-76) relates to a method of determining the absolute value of the OPL by computing it with an iterative algorithm, based on an

estimation of the derivative of the phase of an optical interference signal as a function of wavelength (claim 2). The objective problem can thus be formulated as to obtain a higher level of accuracy. The iterative algorithm based on the derivative of the phase as a function of wavelength is considered to be the Special Technical Feature (STF) for the first invention.

The second invention (claims 35, 73, 77) relates to a method of removing the cross-talk term in an optical interference signal obtained from the sensors. This is accomplished by a process comprising the subtraction of cross-talk phasors. The best prior art discloses neither the problem of eliminating cross-talk nor the process of subtracting cross-talk phasors. The objective problem can thus be formulated as to eliminate cross-talk. The process of subtracting cross-talk phasors can be considered to be the Special Technical Feature (STF) for the second invention.

The two inventions do not share common STF. It cannot be claimed either that the STF of the two inventions are corresponding since the effects of these STF are not corresponding and the two inventions address different objective problems. In conclusion, therefore, the two inventions are not linked by a common or corresponding special technical feature and define two inventions not linked by a single general inventive concept. The application, hence does not meet the requirements of Unity of Invention as defined in Rule 13(1) & (2) PCT.

The search has been carried out only for the first invention, i.e. claim 1, 2, 39, 40 (for non-establishment of search report and no examination of claims 3-34, 36-38, 41-72, 74-76, see Item III).

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1 and 39 is not new in the sense of Article 33(2) PCT.

**Claim 1**

The document **D1** discloses (the references in parentheses applying to this document):  
A method of measuring a parameter with an apparatus having a plurality of laser light

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(SEPARATE SHEET)**

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sources (14, 15, 16...N), launching light at different wavelengths  $\Lambda_1$ ,  $\Lambda_2$ ,  $\Lambda_3$ ... $\Lambda_N$  in an optical fiber (23). The optical fiber (23) comprises a series of reflectors (13) arrayed (11) along the fiber (23). A return optical signal for each of the wavelengths  $\Lambda_1$ ,  $\Lambda_2$ ,  $\Lambda_3$ ... $\Lambda_N$  is collected and analyzed to determine a parameter of interest at a given location along the fiber (col. 2, lines 50-55). The value of this parameter is derived from the measurement of an optical path length (OPL) between the reflectors (col. 4, lines 30-40; fig. 1)

**Claim 39**

The remarks given above for method claim 1 apply, mutatis mutandis, to the corresponding apparatus in claim 39.

**Remarks**

The combination of the features of dependent claims 2 and 40 with independent claims 1 and 39 respectively is neither known from, nor rendered obvious by, the available prior art.